5.6 BARRIERS

Shelter belts, shrubs, grasses, and annual crops have been used as vegetative barriers to reduce wind speed. To describe the impact of the barrier on wind erosion, the barrier was assumed to protect the downwind surface for a distance equal to 10 times the effective height of the barrier. This rule is valid for one wind speed, one barrier density, and one surface condition.

A barrier is most effective when it is perpendicular to the erosive wind. For most regions of the country, wind directions are not constant. In RWEQ, erosion is computed along the path of the dominate wind direction. Erosion is also computed for the two directions 90 degrees (perpendicular) to the dominant wind direction, and for the direction that is 180 degrees (opposite) to the dominant wind direction. These erosion computations are added to determine total erosion for every time period.

In RWEQ97, a new barrier routine has been developed that permits the input of wind speed, barrier height, spacing, and optical density (OD) to compute the protected zone downwind. This routine uses a measured or estimated optical density of the barrier along with the effective height.

To demonstrate the influence of barriers on wind erosion the basic management input file (TESTH.MAN) is used with the weather file for Big Spring, Texas (TX23005.DAT) or a modified weather file (MODPPPR.DAT). (Table 5.6.1.) This modified weather file is the Big Spring, Texas weather file which was modified by setting the wind directions to 0°, the preponderance values to 10, and the positive parallel ratios to one for each month. The soil properties in TESTH.MAN are for a sandy loam (64% sand, 26% silt, 0.5% organic matter, and 3% calcium carbonate, no rocks). The field geometry is a square (660 feet x 660 feet), 10-acre field with no hill. The barrier inputs are added to the **`DOABLE SCREEN`** by pressing F9 under **`Barrier`**. The barrier data is input in the **`Field Barrier Information`** screen (Figure 5.6.1).

Table 5.6.1

RWEQ INPUT FORM

CLIENT: TESTH WEATHER FILE: W\TX23005.DAT MANAGEMENT FILE: TESTH.MAN

Soil Properties:
soil texture SANDY LOAM OR sand 64 %
silt 26 %
organic matter 0.5 %
calcium carbonate 3 %
rock cover – %

Field Geometry: shape circular or rectangular
area 10, acres
orientation 0, ° from north
length_N 660, feet
slope gradient –
slope length –, feet

Longitude____ Latitude____ Elevation____ Annual Rainfall____

DATE	VEGETATION					OPERATION / EVENT									IRRIGATION			BARRIERS			
	Residue	Yield	% Cov.	# Stems	Growing Crop	Implement	Mod. Rough.	RR	Ridge Spac.	Ridge Ht.	Ridge Orient.	Kill Crop	% Flat	% Stand.	Amt.	Rate	# Days	Ht.	DI	Spac.	Orient.
1/1/98	NONE	–		–	NONE	NONE	N	–	–	–	–	N	-	-	-	-	-	2	50	50	0
12/31/98	NONE	–		–	NONE	NONE	N	–	–	–	–	N	-	-	-	-	-	2	50	50	0

Figure 5.6.1.

```
========================REVISED WIND EROSION EQUATION========================
 Client: TESTH                         Weather File: W\TX23005.DAT
                        Man. File:TESTH.MAN

       Soil                     Field       EF: 0.51        SCF: 0.6024
                                  DOABLE SCREEN
    Date                                                                Period
   Start       Vegetation        Operation/Event  Barrier  K'   K''  V   Erosion
01/01/1990 NONE                NONE                 No   0.00 0.00 0.00    0.0
12/31/1990 NONE                NONE         Field Barrier Information
  /  /                                           Optical
  /  /                              Height      Density     Spacing    Orient.
  /  /                              ------      -------     -------    -------
  /  /                               2.0         50.0        50.0        0.0
  /  /
  /  /                                            No   0.00 0.00 0.00    0.0
---------------------------------------------------------------------------
                                               Erosion (t/ac):           0.0
<KEY_F5> =Accept Barrier Information
       Press F1 Key Twice to View HELP on SPECIAL FUNCTION KEYS
Press <enter> to continue or type orientation from North (0-360).
```

For this example the client file TESTH is called into the program. To show the effect of height, spacing, and optical density the TX23005.DAT weather file is used. The modified weather file (W\MODPPPR.DAT) is used to show the effect of barrier orientation.

Table 5.6.2. Erosion estimates with TESTH.MAN and TX23005.DAT on square, 10-acre, sandy loam field. With *no* barriers the erosion estimate is 367.3 t/ac.

When optical density = 50%, spacing = 50 feet, and barrier orientation 0°,

Barrier height, *ft*	2	5	10
Erosion estimate, *t/ac*	211.8	140.1	78.5

When height = 5 feet, spacing = 50 feet, and barrier orientation = 0°,

Optical density, *%*	10	50	100
Erosion estimate, *t/ac*	182.0	140.1	129.6

When height = 5 feet, optical density = 50%, and barrier orientation = 0°,

Barrier spacing, *ft*	10	50	100	200
Erosion estimate, *t/ac*	86.2	140.1	197.7	263.9

If the optical density is 50 % and the barrier spacing is 50 feet, increasing the barrier height from 2 to 10 feet decreases erosion from 211.8 to 78.5 t/ac.

If the barrier height is 5 feet and spacing is 50 feet, increasing optical density from 10 to 100% (100% is a solid barrier) decreases erosion from 182.0 to 129.6 t/ac.

If the barrier height is 5 feet and the optical density is 50 %, increasing barrier spacing from10 feet to 200 feet increases erosion from 86.2 to 263.9 t/ac.

Table 5.6.3. Erosion estimates with TESTH.MAN and W\MODPPPR.DAT on square, 10-acre, sandy loam field. With *no* barriers the erosion estimate is 373.9 t/ac.

When height = 5 feet, optical density = 50 %, and spacing = 50 feet,

Barrier orientation, °	0	30	45	60	90
Erosion, *t/ac*	372.1	113.2	24.6	13.2	2.7

If the barrier height is 5 feet, the optical density is 50 %, and the spacing is 50 feet, changing the barrier orientation from 0 to 90° decreases erosion from 372.1 to 2.7 t/ac.

The effectiveness of barriers is largely dependent on the preponderance values in the weather file. The more dominant the wind direction, the greater the benefit from orienting the barrier perpendicular to the wind, reducing barrier spacing, increasing barrier height, or increasing barrier density.